

#### **4.2 Climate change-induced range shifts**

Climate change is altering the distribution patterns of reptile species, with over half of the species experiencing a decrease in their distributional ranges (Li et al., 2024). This shift is driven by changes in temperature and precipitation patterns, which affect the availability of suitable habitats. Some species may benefit from climate change, experiencing an expansion in their potential distribution range, but the overall trend indicates an increased extinction risk for many reptiles (Razgour et al., 2017). Understanding the movement ecology and landscape connectivity is essential for predicting population persistence under these changing conditions.

#### **4.3 Invasive species and disease transmission**

Invasive species and disease transmission pose significant threats to reptile populations. Invasive species can outcompete native reptiles for resources, alter habitats, and introduce new diseases (Hu et al., 2020). The introduction of non-native species often leads to ecological disturbances that can have detrimental effects on native reptile populations. Additionally, diseases transmitted by invasive species can further exacerbate the decline of vulnerable reptile populations.

#### **4.4 Overexploitation and illegal wildlife trade**

Overexploitation and illegal wildlife trade are critical threats to reptile conservation. Many reptile species are targeted for their skins, meat, and as pets, leading to unsustainable population declines (Perry and Mitchell, 2021). The illegal pet trade, in particular, poses a significant risk to certain species, such as the sailfin lizards in the Philippines, which are heavily exploited despite their limited habitat protection (Siler et al., 2014). Conservation efforts must address these threats by implementing stricter regulations and enhancing enforcement to protect these species from exploitation.

### **5 Conservation Strategies Based on Ecological and Evolutionary Principles**

#### **5.1 Habitat restoration and connectivity planning**

Habitat restoration and connectivity planning are crucial strategies for maintaining genetic diversity and reducing the risk of extinction in reptile populations. As human activities continue to fragment habitats, the connectivity between populations diminishes, leading to increased inbreeding and loss of genetic diversity. This can result in lower adaptability and higher probabilities of extirpation. Studies have shown that managed connectivity, such as through habitat corridors, can significantly reduce these risks by facilitating gene flow and maintaining genetic variability. For instance, an agent-based model demonstrated that increased connectivity prevented extirpation in a majority of critically endangered populations by reducing inbreeding depression and altering evolutionary trajectories (Lamka and Willoughby, 2023). This approach is particularly beneficial for small populations that are most vulnerable to genetic drift and inbreeding.

Moreover, integrating ecological and evolutionary processes in reserve design can enhance conservation outcomes. By using landscape and genetic tools, conservationists can target both species and lineage diversity, ensuring that protected areas encompass a wide range of genetic variability. This method has been applied successfully on islands, where high levels of endemism and restricted ranges make species particularly vulnerable to habitat fragmentation (Vasconcelos et al., 2018). Such strategies not only preserve current biodiversity but also enhance the long-term adaptability of populations by maintaining ecological and evolutionary processes.

#### **5.2 Assisted gene flow and genetic rescue**

Assisted gene flow and genetic rescue are strategies that aim to enhance genetic diversity and adaptive potential in small, isolated populations. These approaches involve the intentional movement of individuals or genetic material between populations to introduce new genetic variants and reduce inbreeding depression. For example, genomic assessments can identify locally adaptive genetic variations that are crucial for the survival of species in changing environments. By planning and monitoring these genetic interventions, conservationists can ensure that the introduced genetic diversity aligns with conservation objectives and enhances population resilience (Flanagan et al., 2017).